

SEP 18 2015

April

6872

Evaluation of Sep NOI change document by William P. Johnson 09/18/2015

Dir. of Oil, Gas & Mining

Suggestions:

Monitoring of major ions should continue indefinitely since many of these constituents are relatively conservative (do not sorb) and so may have the best possibility of indicating influence from mining/processing/disposal activities.

With respect to monitoring for organic compounds: d-limonene alone is too specific. Monitoring should also include diesel range organics (DRO) and gasoline range organics (GRO).

Monitoring should be performed spring, summer, and fall of each year until 10 years beyond the lifetime of the operation. The cost of this monitoring is very modest and there is no reason not to continue the three per year sampling plan indefinitely.

An explanation of the method to measure flow from PR spring is needed since flow from the stand pipe comes from a cistern. A plan should be provided to monitor rate of flow into the cistern. Measurement of flow from the stand pipe alone will not provide useful information.

The significance of flow measurement from the large diameter pipe (misidentified in the NOI as MC-C) needs to be clarified. The rate of that flow will depend on the height of water in the pond from which it feeds.

Flow measurement should be made at the actual MC-C.

An explanation of the method to measure flow at the actual MC-B is needed. Note that MC-B was misidentified in the NOI.

Factual errors:

1. Spring MC-C was incorrectly identified. Figure 5 shows a pipe emanating from a fenced pond which is spring fed. This large diameter pipe is not MC-C. MC-C is what is shown in photo 11, and referred to as "small seep discharge".
2. Spring MC-B was incorrectly identified. The dry spring that was incorrectly identified as MC-B existed at a higher elevation on a stream terrace to the southeast of the channel in Main Canyon. MC-B is in the Main Canyon channel below the dry spring.

In order to avoid future misidentifications it may be useful to have Dr. Johnson accompany DOGM and or USOS in the field.

Analysis of statements made:

Section 1.1 regarding "shallow aquifers" claims that a vast amount of data exists demonstrating an absence of an aquifer at depths to 350 feet below the ridge top. As explained in Johnson et al. (2015), there is no expectation of an "aquifer" at the ridge top since it is the top of the hydrologic system. The implication that a geologic dip (notably 2-3 degrees) to the north prevents flow from

the ridge top to Main Canyon is unsubstantiated and is unlikely. The use of the term geologic "strike" and "dip" conflates two terms with distinct meanings, and these attributes are not co-directional. The term "sustainable aquifer" is not defined nor is it relevant to the fact that the published data indicate that the source of the springs is the ridge top. With respect to the northward dip of the strata, the vertical drop to the south side over the lateral distance from the ridge top to the bottom of Main Canyon is 1310 ft/6560 ft which is a grade equal to 20%, which is equal to 18 degrees. The grade to the south is therefore between six and nine times steeper than that corresponding to the dip of the strata, which creates a very strong potential for the flow to move south from the ridgetop. The northward dip of the strata could prevent that southward flow only if it lacked fractures. The presence of fractures is always assumed in hydrologic transport since all geologic units show fracturing over field scales. The hydrologic literature is replete with examples showing that contaminants travel through so called confining layers because they are fractured. Hence, if USOS wishes to make the argument that a 2-3 degree dip prevents flow from the ridge top to Main Canyon, the burden falls on USOS to prove an absence of fractures in the strata. It should be noted that fracturing of stratigraphic units on the north side of Main Canyon is visibly rampant.

Section 1.1. Wells and Deep Aquifers: Water in USOS well 4 shows distinct characteristics relative to the springs, and so should not be expected to represent the springs.

Section 1.1. Springs: With words like "only a few" USOS continues to attempt to undermine the importance of the springs as essential water sources for ranchers, livestock, wildlife and recreationalists.

Section 1.2: The statement: "Without exception, all springs were found to be emanating from an east or south bank" does not reflect spring MC-D or PR Spring. Furthermore, it does not consider the visible efflorescence indicating numerous seeps on the cliffs bounding the north side of Main Canyon. Finally, the significance of a spring emanating from the "east or south bank" is not clear across the scale of Main Canyon. For example, an east bank spring at the location of MC-A is as consistent with recharge at the project ridge as at Horse Ridge. The implied conclusion of the statement is that Horse Ridge, not the project ridge, is the recharge zone for the springs. This implied conclusion is not sufficiently substantiated by the casual observations. Professional hydrologists need to maintain the distinction between conjecture and fact, and it is assumed/hoped that the document incorrectly attributed these conclusions to the DOGM hydrologist. The possibility that only Horse Ridge provides recharge to Main Canyon would need much greater substantiation than a 2-3 degree strata dip and incomplete casual observation of spring locations.

The statement: "It was also clearly observed that PR, MC-C, and 49-1563 springs issue at a geologic interface on top of confining bedrock ... For the above reasons it is firmly believed that all noted springs are hydrologically disconnected from the project area." This statement is unsubstantiated since it lacks identification of units at the interface and measurements of unit properties that substantiate a "confining" unit. However, even if the statement were substantiated, the conclusion is a non-sequitur. That a spring discharges at the interface with a geologic unit having lower

hydraulic conductivity demonstrates that the water must have come from higher elevation. This supports rather than refutes recharge at the ridge tops.

Statements in Section 1.2 include unattributed quotes that reflect individual opinions, and in some cases incorrect identifications, rather than analysis of hard data.

Section 2.1: A calculation is made using a literature value to represent hydraulic conductivity at the site in order to suggest that baseline conditions likely still exist at the springs. The statement refers to permeability but gives units of hydraulic conductivity. There is no basis for assuming that the 1 m/day value is representative of the ridge. Baseline chemical analyses were performed by the University of Utah and are available on request.